

From the house of Amar Chitra Katha and Tinkle

TM

BRAINWAVE

Vol. 02 Issue 01
January 2013
48 pages
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MEET THE SMARTIES



Dr. Dodo: Dr. Dodo is the co-founder of BW Labs and is the last living dodo. He holds a PhD in anachronomaly and parallel universes from the University of Clockwindistan. He invented the Galileo series of time machines.



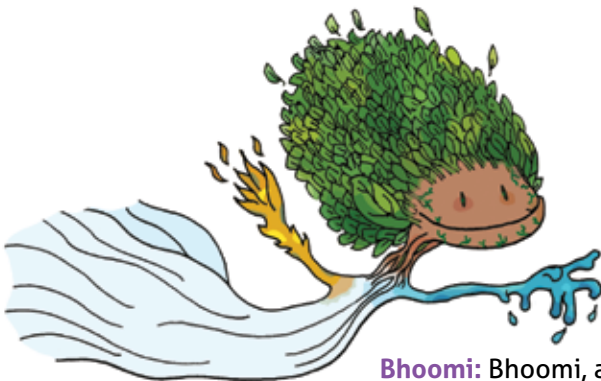
Skree!: Skree! is the other founder of BW Labs. She loves dangerous experiments. She makes mini black holes before breakfast and has dark matter for lunch.



Arby: Arby is a genius who will grow up to be Aryabhata. He came to the future, thanks to Dr. Dodo's time machine. He is a fan of numbers, banana fritters and robot wars.



Alby: Alby will grow up to be Albert Einstein. However, now, like Arby, he too has been sucked into the future. When he is not researching, he plays the violin.




Bhoomi: Bhoomi, a.k.a Bhoo, is an enigma. No one knows where she is from and how she came into being. She is made up of earth, wind, fire, and water in equal parts. Her alter-ego is Gaia Goel, a world famous science sleuth.

Lightning strikes!

Dear Reader,

Centuries ago, people thought that lightning was one of the effects of magic. A brilliant man, Benjamin Franklin thought differently. He proved that friction between water and ice particles in rain clouds caused lightning.

Franklin's brainwave  made electricity an important branch of physics. Following his work, scientists studied many concepts of electricity in depth. Flip through this issue to find some crazy, electrifying facts.

Scientifically,
JD.

jayadev.calamur@ack-media.com

Cover artwork by **Prabha Mallya**



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BRAINWAVETM

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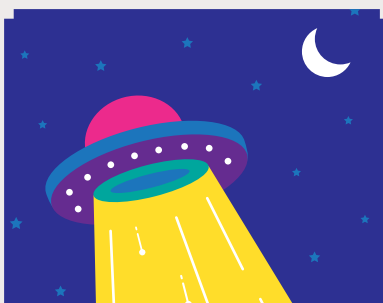
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CURRENT AFFAIRS



In which we have zapping adventures with electricity while encountering kites in storms, time machines, electric cars and more...

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Static Magic

Turn an ordinary drinking straw into a magic wand and amaze your friends!



by Arvind Gupta
& Kayomarz Bacha

To make this, you will need:

- A medium sized tea cup (paper cup)
- A plastic straw
- A sharpened pencil
- A tissue paper
- A piece of paper (approx. 10 cm x 5 cm in size)



Method:

Step 1

Invert the paper cup and insert the pencil to make a hole in the centre of the cup. Make it stand.



Step 2

Follow the diagram shown below and fold the paper to locate the centre.



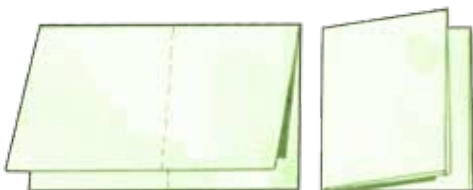
Step 3

Balance the paper on the pencil tip. Make a tiny hole at the centre of the paper to balance it easily.



Step 4

Fold the tissue paper twice as shown below.



Step 5

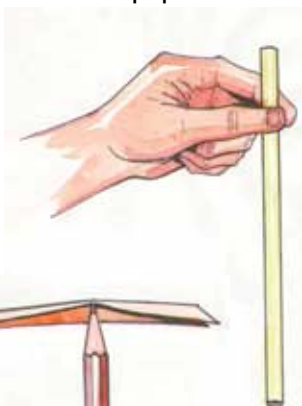
Rub the straw with the folded tissue paper for at least 30-45 seconds. This will electrically charge the straw.



Step 6

Bring the straw close to the end of the paper and observe what happens.

Note: Do not let the paper touch the straw.



Congratulations! You have made your own magic wand! ■

Why does this happen?

Static electricity is the buildup of electrical charge on the surface of an object. It is created when materials are rubbed together, causing positive (+) charge to collect on one material and negative (-) charge on the other. This also results in sparks, shocks or materials sticking to each other.

In this case, when the straw is brought closer to the paper, the paper gets attracted to it.

You can try variations of this:

- Use a circular piece of paper instead of a rectangular one. Colour the paper to make it look attractive when it rotates.
- Use straws of different thickness. Rub the straw with the tissue paper longer and with more force.
- Place the charged straw near a thin stream of water flowing from the tap in your kitchen sink. Observe what happens.

Make this toy, try the variations and email your observations to kayomarz.bacha@ack-media.com. You can win a copy of 'The Blue Umbrella', an Amar Chitra Katha comic!



NOW, YOU CAN COUNT THE STARS!



The Sky through the Gamma-ray telescope; Image Source: NASA

In November 2012, astronomers used NASA's Fermi Gamma-ray space telescope to measure the background light from stars in the **cosmos**^G.

The Fermi telescope uses

gamma rays to detect the stars because gamma rays are the most energetic form of light. They sometimes have a billion times more energy than visible light.

Through their research, the

scientists have concluded that the number of stars in the universe is 1.4 stars per billion **cubic light years**^G, which is roughly 4,150 light years between each star. This is only a tiny indication of how large the universe is! ■

WANT TO LIVE ON MARS?

Elon Musk, billionaire, founder and CEO of a private space flight company, SpaceX has plans to build settlements on Mars.

He says that he will take 80,000 people to Mars over two decades, on reusable rockets powered by liquid oxygen and methane. He would charge

them 500,000 US dollars each.

"On Mars, you can start a self-sustaining civilization and grow it into something really big," he says.

He adds that with the carbon dioxide available in the atmosphere there, Mars' soil would be conducive to grow crops. Natural elements like nitrogen, carbon dioxide and ice water that are available on Mars can help in the production of fertilizers, methane and oxygen. ■

WHEN NILAM & SANDY WREAKED HAVOC

It is the perfect prelude to the end of the world, isn't it? Thankfully, we did not perish on December 21 and have reached a new year. It is now essential that we take notice of the changes taking place in nature. Hurricanes Sandy and Nilam have caused devastation across



Hurricane Sandy; Image by UN

the United States and India, respectively.

Sandy, the deadlier of the two, affected both the east and the west coasts of the United States. In India, Nilam wreaked havoc in parts of Andhra Pradesh and most of Tamil Nadu.

Hurricanes, tornadoes, melting icecaps, heat waves, and sandstorms have begun to occur rather frequently. These problems cannot be solved overnight. Each one of us needs to do his or her share to conserve the environment and prevent such natural disasters. ■

AN SMS YOU WOULD LOVE TO RECEIVE!

You can now spot the International Space Station that was commanded by Indian-American astronaut Sunita Williams, without a

telescope. Through its 'Spot the Station' service, NASA sends SMSes or emails to people who wish to see the station, a few hours before it passes over their house.

You can register for this service at <http://spotthestation.nasa.gov>.

This is definitely one random message you would not mind receiving! ■

HEAR LIKE AN INSECT



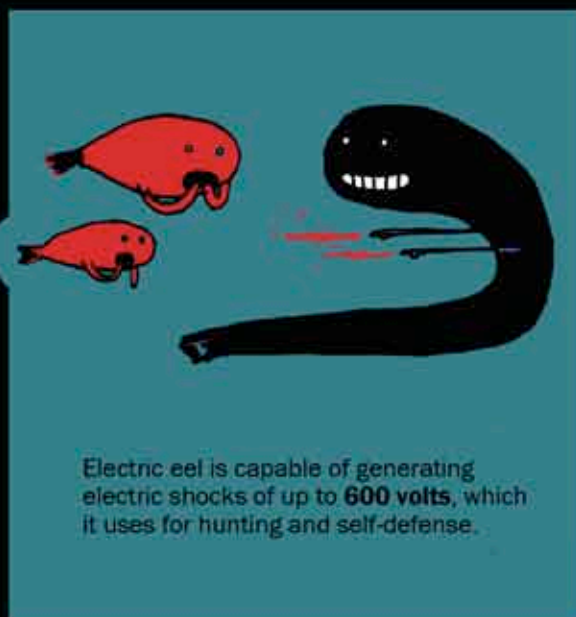
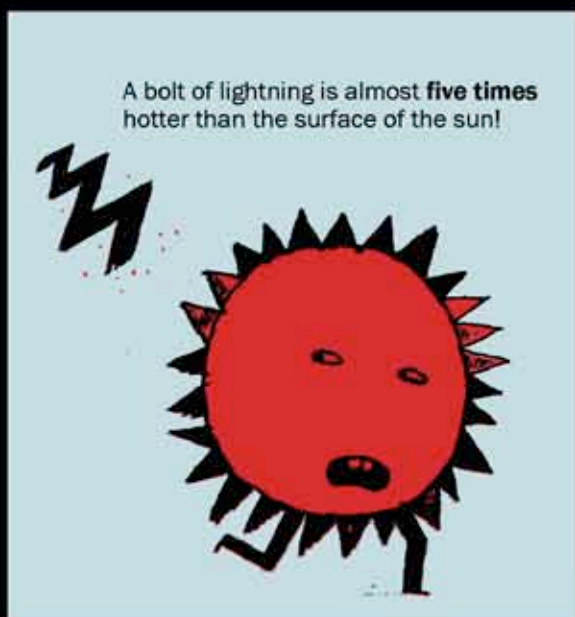
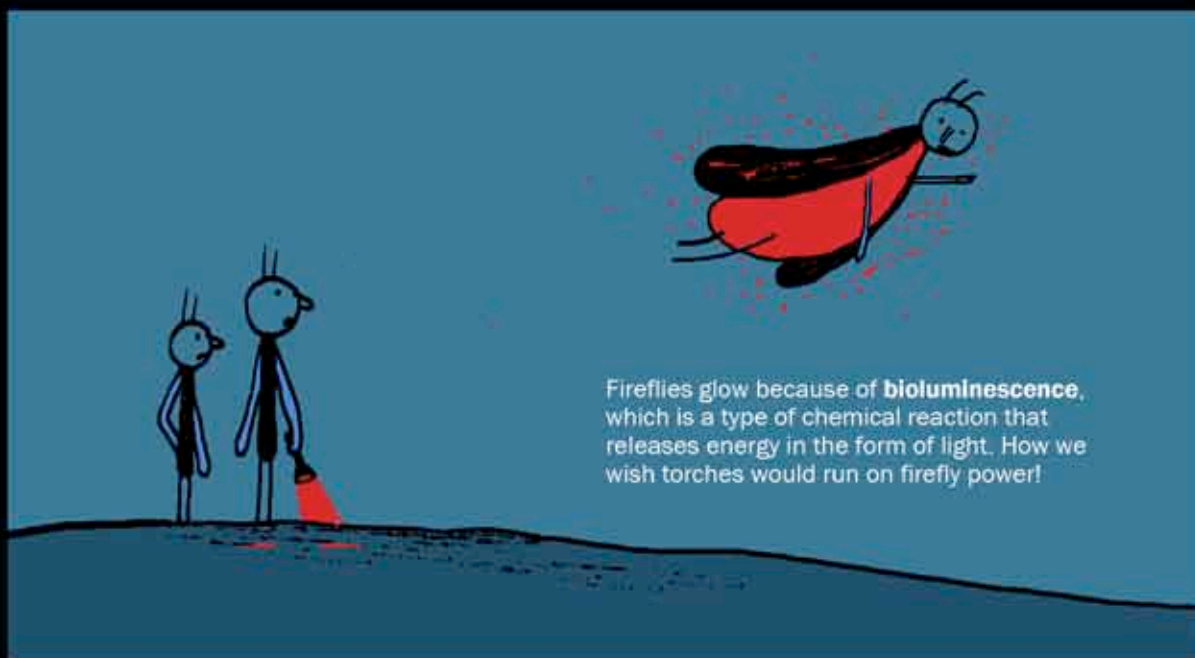
Bushcricket; Image Source: Niklas N

A newly discovered hearing organ in the South American Bushcricket's ears could hold clue to super-human hearing.

This discovery could pave way for advancements in the development of bio-inspired acoustic sensors and hearing aid.

This organ mediates the conversion of sound waves into mechanical, hydraulic, and electrochemical energy to make hearing more effective. ■

by Upasna Menhdiratta





by Srinath Perur

Is it a bird? Is it a plane? No, it's a UFO!

Ajeet Mahale asks: Are the UFO sightings reported on the Internet real or fake?



UFOs or Unidentified Flying Objects, have increased our curiosity to know about the existence of life beyond earth. People have often reported sightings of strange shapes or lights in the sky. Usually, there are scientific explanations for what they have seen. These objects are large weather balloons, aircrafts, patterns formed by stars and planets, meteorites, strangely shaped clouds or

man-made satellites.

On several occasions, the sightings can be illusions. Some of these things may not even exist. For example: as the sun or moon passes through ice crystals in the atmosphere, a mirage of bright patches occurs. These bright patches are called sundogs and moondogs. In order to fool people or garner attention, morphed photographs are shared on the Internet. Unfortunately, the buzz tends to go viral.

Recently, websites were abuzz with reports of unrecognized flying insects that were long and fuzzy. These insects were named 'rods'. Apparently, their peculiarity was that they could only be spotted in photographs or videos. Some even claimed that these rods were an alien life form. But it was all quite easily explained. They were normal insects – bees, moths and dragonflies. Photographers used different shutter speeds to shoot these insects, which made them look different. A hue and cry was raised for absolutely nothing.

Today, information is easily accessible on the Internet. This makes differentiating between real and fake news difficult. It is best to research deeply, understand the science behind each report and decide for yourself. ■

Famous UFO sightings

- After World War II, a UFO was reportedly sighted in Los Angeles, California. The US Army thought that it was another attack by Japan and proceeded to launch anti-aircraft missiles.
- The Belgian Air Force tracked unknown objects on its radar and described them as black triangles with bright lights that change colour. The Belgian Air Force still offers no explanation for those objects.

~~~~~  
Have a burning question? Email us at [brainwave@ack-media.com](mailto:brainwave@ack-media.com) with 'Ask Us Why' in the subject line. The published question will win the latest Tinkle Holiday Special comic.  
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CAR TALE

Story by Jayadev Colamur

Artwork by Devashish Guraji

This is MY invention!

(Sigh!) Didn't patents exist back then?

History is uncertain about the inventor of the electric car.

Aayos Jedik of Hungary, Robert Anderson of Scotland, Prof. Stratingh of Holland and Thomas Davenport of the USA are credited with the invention.

I'm the king of the road!
Yeah!

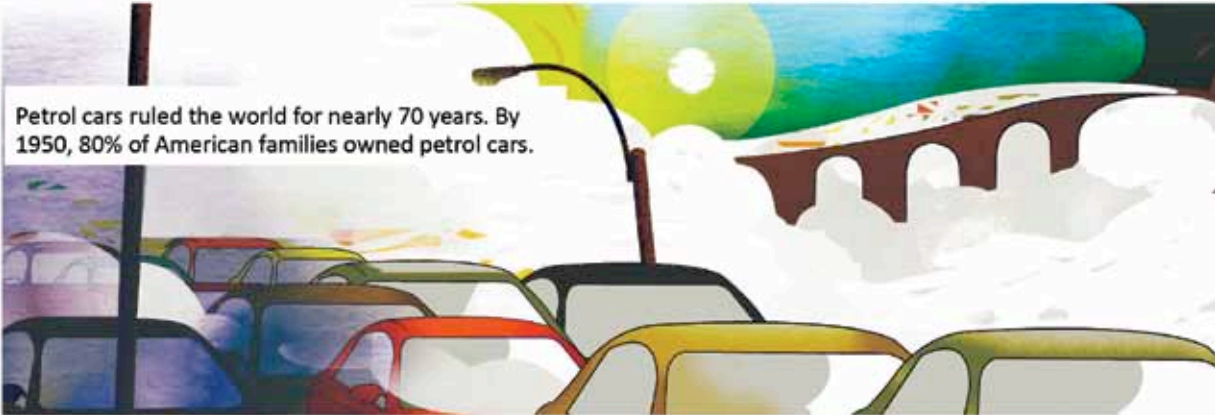
The early years were good for the electric cars, as there was no gasoline competitor. But all good things someday come to an end!

Petrol cars could last longer distances.

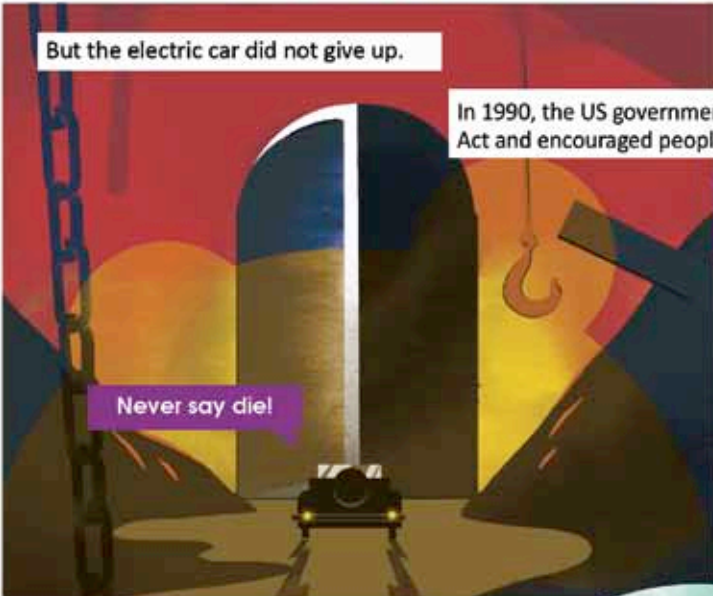
I can last long, really long!

The reason for the petrol car's success was the discovery of crude oil in Texas.


Petrol became cheaper and electric cars went out of fashion.



Petrol cars ruled the world for nearly 70 years. By 1950, 80% of American families owned petrol cars.



But the electric car did not give up.



In 1990, the US government came up with an amendment to the Clean Air Act and encouraged people to buy electric cars.

Let's go back to the old drawing board and work on electric cars.

Never say die!

Chevrolet, Ford, and GM redesigned their cars and people got drawn towards the new designs.

In India, the Mahindra group started manufacturing the Reva. It is slowly gaining popularity

I'm the king of the road! Yeah!

This is so cool. It may cost more, but it's cheaper in the long run.



THE ELECTRIC CAR IS BACK!

*Our resident geek
Kayomarz Bacha
takes a trip to
Brainwave Labs
to understand the
concepts of
electricity better.*



Artwork: Abhijeet Kini



Current Affairs

by **Kayomarz Bacha**
Characters created by **Vinayak Varma**
© **Brainwave**

I headed to the Brainwave Labs (a.k.a. BW Labs) to learn more about electricity. JD thought that there was no better way to do it. After exchanging a few emails, the Smarties had agreed to "electrify" me with the knowledge I needed.

I was blindfolded and taken to the lab, since its location was a secret.

Once I reached the lab, the Smarties greeted me with a cup of hot chocolate.

"Shall we start?" they asked.

"Yes. JD put me to the task. Frankly, it is boring to study electricity!" I complained.

"On the contrary, my boy, electricity is extremely fascinating to study! It is not just about circuits, laws and theories," said Dr. Dodo. "All that you enjoy today – car, train, light bulb, fridge, AC, TV, and even your mobile phone and computer – are results of that study."

"Wow, wonder how people lived before that!" I exclaimed.

"Yes, imagine it!" said Dr. Dodo, "Although electricity always existed, related scientific advances were not made until the 17th and 18th centuries."

"In fact, the ancient Egyptians knew that some fish produced shocks. People called them 'Thunderers of the Nile' and 'protectors' of other fish." Skree! pitched in. "People also noticed that amber attracted smaller particles when rubbed with animal fur."

"Oh yes, in school, we used to rub plastic rulers on our hair, and it would attract small pieces of paper," I said.

"Yes, Kayo," agreed Dr. Dodo, "That is static electricity. It is a build-up of non-moving charge. When the same is caused due to the movement of free electrons through conductors, it is current electricity. It is current electricity that we mostly use in our day-to-day life."

"Conductors?" I queried.

"Conductors are those through which electrons and hence, electric charges flow easily. Most metals and salt water are examples," detailed Dr. Dodo. "Similarly, there are other materials that are poor conductors. These are called insulators and are used to prevent electric shocks. Wood and plastic are examples."

"Okay. If current electricity is what we use everywhere, what is the significance of static electricity?" I asked.

"A very good question," said Dr. Dodo. "Bhoo will answer that. She is an expert as she has the power to manipulate electricity as she wants."

"Thanks, Dr. Dodo," blushed Bhoo. "Kayo, static electricity is crucial too. Air purifiers use static electricity to alter the charges in the dust particles so that they stick to a plate or filter of the purifier."

"Xerox machines use static to attract ink to the areas where the information needs to be copied. And to make sure that a car's paint resists high speeds and extreme weather conditions, it is applied with a static charge," concluded Bhoo.

"That is very interesting, thanks to Benjamin Franklin for discovering electricity through his famous kite experiment!" I stated.

"Well, Franklin was the first person to do considerable research. But, he did not 'discover' electricity," interrupted Alby. "In 1746, Franklin learned of various electricity related discoveries and conducted his own research."

"His contribution was very important though," reasoned Skree! "He was the first to discover that electricity contained positive and negative charges. He proved beyond doubt that lightning contained electricity and invented the lightning rod. His research lead to intense study and significant discoveries."

"Yes," Alby agreed. "That is why Arby and I are going back in time, tomorrow, to interview him."

"Wow! That is amazing! Can I come too?" I pleaded.

"Another time," smiled Dr. Dodo. "You still have a lot to learn."

"What more do I need to?" I protested.

Dr. Dodo continued, "Well, do you know how



electricity is produced, transmitted and stored, amongst other things?"

"No," I conceded. "Silly of me to suggest that I have learnt everything. There is always more!"

"That's right," beamed Dr. Dodo. "Bhoo will talk about that."

"Right," Bhoo began. "Different resources can be used to produce electricity. At the core of the process are the generators. Generators are large magnets surrounded by coils of wire. The magnet spins, producing electricity."

"But that is magnetism, right?" I argued.

Electricity shares a close relationship with magnetism. Every electric current



has a magnetic field surrounding it and fluctuating magnetic fields cause current to flow. This is why particles attract and repel each other in an electric field, ■■ intervened Dr. Dodo.

"Yes," added Bhoo. "When the generator spins, a magnetic field passes along the wires, 'pulling' electrons into a current. The same basic process is used everywhere, just that the energy resources used to spin the generator vary – like coal, wind or water."

"Cool! What about transmission and storage?" I asked.

"Electrical current is distributed to us over a system of transmission wires, substations and transformers," added Bhoo.

"Transmission wires carry high-voltage current over long-distances. Once the power reaches its destination it is 'stepped down'^G through substations and transformers to lower, useable levels. It is then distributed over lower-voltage lines to our homes," she continued.

"But storing electricity is very inefficient as of now. Power plants sell extra energy at lower prices or let it go unused and lost," she concluded.

"We can store electricity in batteries, can't we?" I prompted.

"Yes. But power plants generate huge amounts of energy. Batteries cannot store all of the energy. Also, storing it costs more than the cost of producing it," detailed Dr. Dodo.

"But, new ways of generating electricity are being invented," said Bhoo. ■■ Solar energy is directly converted into electricity using photovoltaic cells^G. Fuel cells use hydrogen to produce electricity. Hopefully, in the near future, better and cost efficient devices will be built to store electric energy. ■■

"Phew!" I exclaimed. "Very interesting indeed."

"Great," said Dr. Dodo. "I guess we have covered the basics. Do you have any specific questions?"

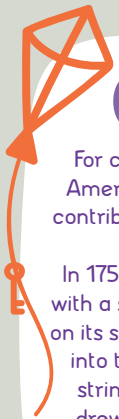
"No," I answered. "This is enough information for now. I will first digest this, write my cover story and meet you again to know more."

"Sure. You can use the Internet to dig deep. If you have any doubts, ask us," encouraged Dr. Dodo. "And good luck!"

And that is how I realized that electricity plays a very crucial role in our lives and that it is great fun to learn about it. ■



In the past, people thought that electricity was magic. Ancient civilizations knew of shocks from electric fish and noticed that amber, when rubbed with silk, attracted smaller objects like feathers. Take a look at how electricity has evolved since then, to become a necessity in our lives.



STATIC ELECTRICITY

For centuries, nobody studied electricity. Then, American thinker Benjamin Franklin made major contributions to advance the science of electricity.

In 1752, on a stormy night, Franklin flew a silk kite with a sharp pointed wire at its tip, and a metal key on its string. Static electricity passed from lightning into the wire and then, into the key through the string. He then invented the lightning rod, and drew electricity into his house to ring bells and create sparks. He also stated that electricity contains positive and negative charges.



CURRENT ELECTRICITY

In 1800, Italian scientist Alessandro Volta invented the battery. He proved that electricity could travel through wires and paved way for advanced research of current electricity. The unit of voltage is named after Volta.

In 1928, German scientist Georg Ohm explained how current and voltage are interrelated. Ohm's law helps build circuits for all electrical appliances that we enjoy today!

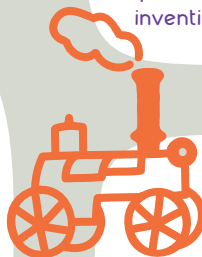


ELECTROMAGNETISM

Scientists soon related electricity and magnetism. French physicist André Ampere played a crucial role in this. The unit of current is named after him. **Electromagnetism^G** gave rise to long distance electric communication – the telegraph, in 1830. Prior to this, long distance messages could be delivered only on legs and horsebacks!

In 1831, British scientist Michael Faraday discovered **electromagnetic induction^G**. This concept is used to build electric generators, motors and transformers that were very crucial to the industrial revolution.

Years later, Scottish scientist James Maxwell theorized that electric and magnetic waves travel at the constant speed of light. This was important for wide ranging inventions like the radio, radar and mobile phone.



INDUSTRIAL REVOLUTION

Advancements in machinery and electricity sped up the **industrial revolution^G** in the late 1800s. Devices like electric generators, transformers and motors played a crucial role in enabling mass production. The principle of James Watt's steam engine helped produce electricity on a large scale. Power is measured in watts as a tribute to him.



LIGHT BULB

People then felt the need to replace oil lamps with convenient alternatives. In 1879, US inventor Thomas Edison, after numerous trials and errors, invented an electric light bulb. He had already built the first **Direct Current** (DC) generator to distribute electricity.

A year later, American inventor Nikola Tesla developed the **Alternating Current** (AC) electrical supply system. AC is better than DC as it generates more power.



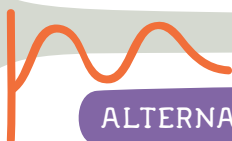
ELECTRONICS

The discovery of electrons led to electronics as a specialist field of study. Several devices, including the television, refrigerator and mobile phone are electronic. Electronics helped convert electric energy into forms beyond light, heat and motion, like audio and video.



BATTERY

Several electronic devices run on batteries. Hence, there was a need for easy-to-use and affordable batteries. After several trials, the nickel-cadmium battery was invented in 1899. It is still widely used in devices like electric torches and remotes. In 1970, the low-maintenance lithium-ion battery was released into the market. It can be recharged repeatedly and is used in mobile phones, cameras and laptops.



ALTERNATING CURRENT

In 1881, a power transformer was demonstrated in London and adopted in Italy. It enabled efficient transmission of electricity over long distances by **stepping-up or stepping-down** the voltage of AC as needed. As a result, Alternating Current became the major supply system of electricity for the world by the early 1900s.



TOOLS FOR COMMUNICATION

In 1876, Scottish inventor Alexander Graham Bell converted electrical energy into sound and invented the first telephone. In 1895, Italian inventor Guglielmo Marconi invented the radio. Both have become essential tools for communication today.

Marconi was inspired by German scientist Heinrich Hertz's work. In 1886, Hertz had demonstrated that rapid variations of electric current could be projected into space in the form of radio waves, similar to those of light and heat.



COMPUTER

The first electronic computer, designed in 1945, weighed 30,000 kgs! Soon, advancements in computer technology came about, finally resulting in the personal computer in the 1980s. Today, we cannot imagine life without computers or the Internet. We would prefer not having electricity instead!



DISCOVERY OF ELECTRONS

Though current electricity was in extensive use, nobody understood how it flowed. This changed in 1899 when J.J. Thomson discovered electrons. Electric current, he inferred, was due to the flow of electrons.



ALTERNATIVE SOURCES

Presently, alternative sources such as nuclear, solar and wave power are being explored to generate electricity. Fuel cell cars have hit the market- Hollywood star Angelina Jolie owns a car that runs on Hydrogen! With further research, these sources may become affordable, more efficient and widely available for home use soon.



SUPERMAN'S HOME FOUND?

by **Kashmira Sarode**

Will the complex theory of space and time travel allow us to see Krypton!?

I magine if you knew where Superman's ancestral home is. Not the Fortress of Solitude that is located somewhere near the North Pole. We are talking about Krypton, the planet on which Superman was born as Kal-El to Jor-El and Lara.

Many would argue that Krypton blew up, which is the reason Superman is on the Earth. But you could still find out its coordinates. In the movie *Superman Returns*, Superman sets out to see if Krypton still exists. He knows the coordinates, but is unable to locate it and returns to Earth.

DC Comics, the company that created Superman, asked astrophysicist Neil deGrasse Tyson to pinpoint the actual



Image Source:DC Comics

location of Krypton. And he did just that!

Krypton is located 27.1 light years away from Earth. That is approximately 270 trillion kilometres away from Earth, according to Tyson.

These planetary details will be encompassed in a new Superman book titled, *Star Light, Star Bright*.

Incidentally, this is not

Tyson's first tryst with comic books or movies. He pointed to James Cameron that the night sky in *Titanic* was inaccurate. This prompted Cameron to make changes when he re-released the movie in 2012.

If ever there came a time in our lives where we could travel that far into space, we could visit Krypton. Because of the complex theory of space and time travel, we might actually succeed! ■



Power-full bill

by Sasikanth C

Unearth some electrifying facts about your household electricity consumption.

First, there was darkness. Then there was fire. Finally, we have light the way it is today.

Can you imagine a day without electricity? Even an hour's power cut leaves us frustrated and we complain that nothing is being done to solve the current power problems.

But, do you know that in 2011, about 30 crore Indians did not have electricity?

Electricity is very expensive and India needs to invest Rs. 7 lakh crore more to provide electricity to all of us.

In the light of such alarming facts, it is important that you understand electricity, its consumption and cost. can be improved and well-controlled.

Answer the below questions. You can ask your parents and teachers for help.



- 1 What was your household electricity bill last month?
- 2 How many units did you consume?
- 3 How much does one unit cost?
- 4 How many watts is each of these units equal to?
- 5 If you use your television or refrigerator continuously for one hour, how much bill will you have to pay? (Hint: First find out the wattage per hour, convert it to billable units and multiply by unit price) ■

Answer the above questions and you can get to be a part of Brainwave's Student Board.
Email your answers to sasikanth.c@ack-media.com as soon as possible.



THE TIME TRAVELLING KUMARS

Story by Jayadev Calamur
Artwork by Devashree Dhakras

In the previous issue, the Kumars began giving a demonstration of their time machine to the representative from Smith Enterprise. Now...

Off we go!

WOOHOOOOO!



I don't know yet.

Where on earth are we headed to?

Take us to the year Mahatma Gandhi was born.



Mohan begins typing out "1869" in the year pad, but a violent jerk shoves him and he types 1879 instead. The machine makes a huge noise and starts moving really fast.

Porbandar, here we come!

Hope this works...



Wow!

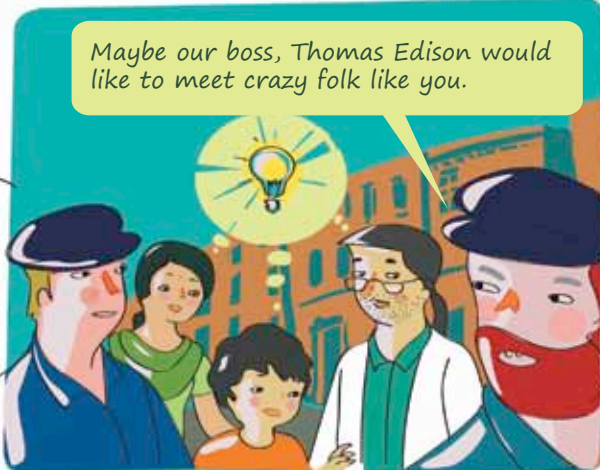
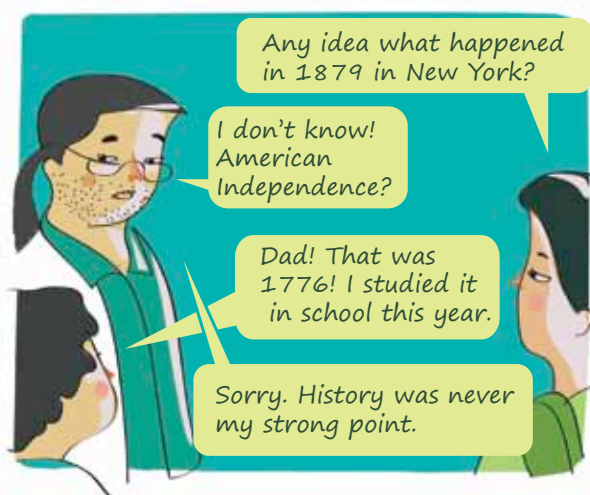
This doesn't look like Porbandar.

Oops!

If only they knew where they were!











ANYTHING FOR SCIENCE

FALLING APPLES! EXPLODING
EGGS! PURPLE BEARDS!!!
O ARCHIMEDES - WHY,
WHY DID YOU JUMP
OUT OF YOUR BATHTUB

UNCLOTHED? SUCH
EMBARRASSING ANTICS-
AND ALL FOR THE LOVE OF
**INVENTIONS AND
DISCOVERIES!**
EXCUSE ME WHILE I
PUT AWAY THIS BOOK
AND GO HAVE AN IDEA.



by PRABHA MALLYA

DARK DAYS NO WAY!



If there was no electricity left on Earth, despite that the world would not stay in the dark forever. A hero will come who will use his abilities to generate power.

The world always had and will face huge problems. During every crisis, different heroes have saved us.

This hero will not use

generators or any fancy gadgets. Born with the ability to generate electricity, he will use his genius for the good of the Earth.

Without electricity the future world could be scary. Criminals could rule society and cops would not be able to catch them easily. Violence and chaos would reign before our hero comes along with his secret

armour and weapons.

He would restore power and bring cheer to the looted cities with the help of the few good survivors. He would take on the evil street gangs and bring in a new age of peace and happiness.

**Daniel Pinto, Age 10,
St. Stanislaus High School,
Mumbai.**

SOLUTION TO THE TREASURE HUNT

We had already mentioned the November 2012 Treasure Hunt and other surprise gift winners in our December 2012 issue. We would also like to mention Arun Prakash, Sudheeksha Rao, Emon Baruah, and Niveditha Varma. We received their responses late. Yet, they were spot on and deserve a mention.

The Winners of the December 2012 Treasure Hunt would be announced in the February 2013

issue. Hold your breath till then!

We have also launched a new contest - 'Be a Smarty' on page 45 of this issue. Take part in it and you can win a remote controlled chopper!

In addition, you can win many cool gifts by taking part in 'Ask Us Why [p9](#)', 'Toy Box [p4](#)', 'Eye See [p19](#)', 'Third Law [p29](#)', 'DIY [p30](#)' and 'Planet Ninjas [p37](#)'.



LETTERS FROM READERS

I made the energy ball (Toy Box in Nov. issue) as a part of my science project recently. I came first. I made a few modifications to the information that you had given. Thank you for giving such a simple yet awesome project! :)
Ishita Gupta, Sanskriti School, New Delhi.

Dear Ishita,
That is wonderful. We are glad that the experiment was successful. Congratulations on your prize. We hope you win many more. Please email your address to us so that we can send you a surprise gift.
Kayomarz Bacha, Resident Geek.

JD, your first issue as the editor of Brainwave was really good. I liked it and hope that you continue publishing stories similar to 'Chasing the Common Cold' and the article on the Bermuda Triangle. I look forward to your next issue. I am sending you a painting. Hope you publish it.
Tanvi Jani, Mumbai.



Tanvi's painting

Dear Tanvi,
Thank you so much for your letter. Continue reading Brainwave and enjoying the stories. We are publishing your painting in this issue. It is some cool art!
JD, Editor.

I love reading Brainwave magazine. I look forward to reading the science fiction stories.
Shruti Anthony, via email

Dear Shruti,
Thank you. We are glad that you loved BW. Keep writing in!
JD, Editor.



Canteen Nightmare!

Harish Mushaib, *via email*.

When I was in school, we had a number of biology experiments that involved dissection. Dissection involves cutting tiny animals, worms, and insects to study their **anatomy**^G. As a part of this, we were studying cockroaches.

We were busy washing our hands, dreading the exercise when the peon came up to the teacher to inform him that there were no more cockroaches in the lab. My teacher, without batting an eyelid, said, “Go get some from the canteen.” All of us were horrified. Five minutes later, the peon returned with a bag full of cockroaches. We had no choice, but to perform the dissection.

While it was a worthwhile lesson, I never ate at that canteen again.

Editor’s note: You will not be introduced to dissection until Class 11 or Class 12. However, it is an interesting set of classes and teaches you a great deal about living creatures.

A Hot Affair

Vikramaditya Goswami, *via email*.

During Class 10, one of the toughest experiments we had in school was one that involved the calorimeter. The calorimeter comprises of a box with a thermometer to measure heat levels. The practical exams would have a series of chits. Each student had to pick a chit and conduct the experiment mentioned in the chit. I got the calorimeter.

Fortunately, I had studied it at the last minute. The teacher shot questions at me and I answered confidently. I came out of the hall heaving a sigh of relief.

I learnt a valuable lesson that day. Never study anything in the last minute. It does not always help.

Editor’s note: The calorimeter is a popular heat experiment that you study in school. You weigh the instrument, heat it to a certain temperature and weigh it again. The difference in weight is the amount of calories burnt. ■

Artwork: Alicia Souza

Email your strange science experiences to jayadev.calamur@ack-media.com with ‘Mailed Tales’ in the subject line.



The Current is Going to Get You!

Imagine how thrilling it would be if you could control the flow of electricity!

by Jayadev Calamur

Have you played games like *Street Fighter* or *Mortal Kombat* and wished that you had similar powers to that of the heroes in the games? Pause and think of what you could do if you had Iron Man's suit or Thor's hammer.

Imagine that you have this super-power and could do some amazing things with it. Write to us, in 200 words, about what you would do. ■

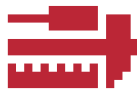
Can you imagine the things you could do if you had the power to release and manipulate electric current?

I am sure that the first thing you thought was, "No more power cuts!"

You would never feel the need to rely on coal or nuclear reactors to give you electricity. You do not have to worry about big electricity bills. There would be no darkness around and you would celebrate **Earth Hour^G** in a very different way!

Three best answers will get a chance to be part of our Student Board. Write to jayadev.calamur@ack-media.com

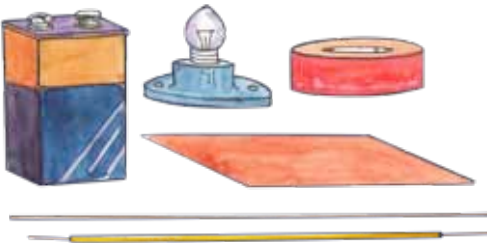




STEADY HAND

Create your own boardgame and challenge your friends to beat you at it.

by **Kayomarz Bacha**



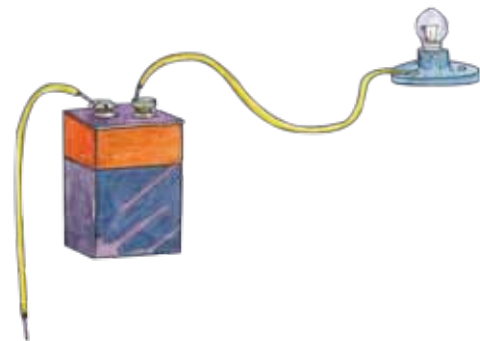
Here is a list of things that you need and their approximate cost -

- One 9V battery (Rs. 40)
- One electrical tape (Rs. 20)
- An alternate insulated bulb holder (Rs. 10)
- One 30" piece of bare copper wire (Rs. 10)
- Two 10" pieces of copper wire, 1" of insulation stripped off at both ends (use any unused wire lying around your home)
- A piece of cardboard or the lid of a shoebox

* The above materials are available at any electrical or hardware store.

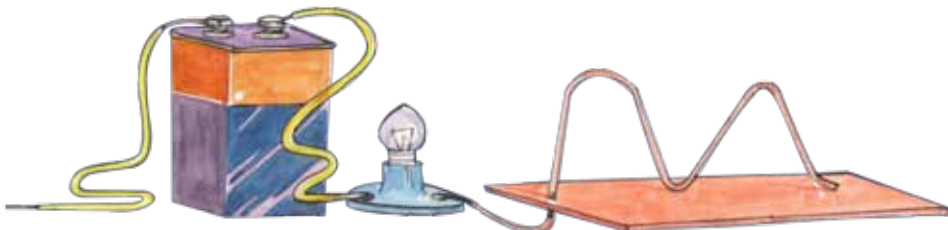
Step 01

Connect the two 10" insulated wires to the battery nodes. Take one wire and connect it to one end of the bulb holder. Keep the other wire free for later.



Step 02

Take the bare 30" wire and connect one end of it to the free end of the bulb. Take the other end of the same wire and push it through one end of the cardboard.



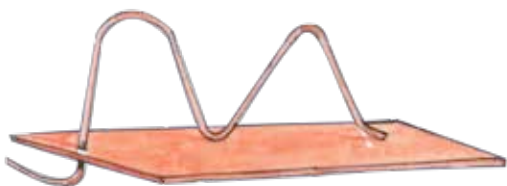
Step 03

Tape the wire at the bottom of the cardboard with electrical tape.



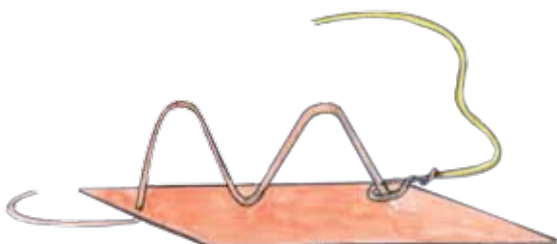
Step 04

Bend the wire you pushed through the cardboard to make the game as difficult as you want.



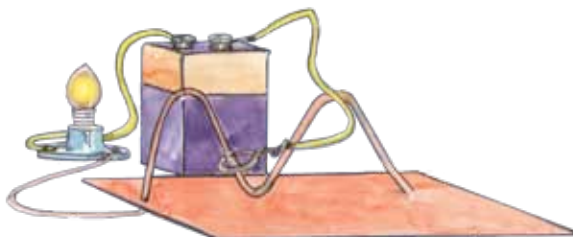
Step 05

Make a loop at the free end of the unused wire connected to the battery and drive it through the bent wire as shown below.



Step 06

Drive the end of the bent wire through the base of the cardboard at the other end. Once the wire is through the cardboard, secure it to the base with electrical tape.



The objective of the game is to move the looped wire from one end of the bent wire to the other end without the bulb lighting up.

When the looped wire touches the bent wire, the bulb lights up.

Your game is ready. You can test your friends to see if they have a steady hand.

How does it work?

Electricity is the flow of electrons through a path. In this experiment, the path is a wire. The path is also called a circuit. The battery has two ends: a cathode, which is the negative terminal and the anode, which is the positive one. When the looped wire touches the bent wire, the circuit is complete. That is why the bulb lights up.

Take snaps or videos while playing the game. Email them to kayomarz.bacha@ack-media.com and you can win a copy of the ACK Comic, 'Jim Corbett'.



POWER BALLAD

by PRABHA MALLYA

Despite Man's best-laid plans, things do go wrong sometimes, even in a time as Advanced as The Future. There is an unexpected power outage lasting a whole day, bringing lives and businesses to a complete chaotic standstill in the country - all because of a tiny rat!



The plug has been pulled on TV and the Internet - so people don't even know what's going on.

People who have driven to work find themselves stuck inside.

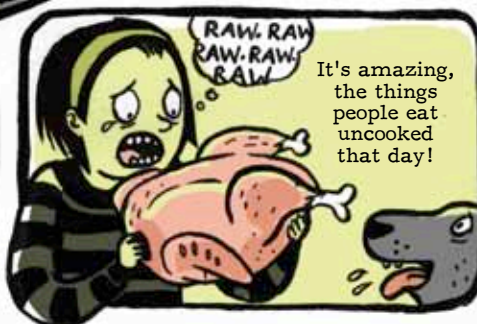


Others are stuck outside office, but not for long.

Some try to go see if the neighbouring city has power.



This is an era of electric vehicles. So - they don't go too far.



Obviously, one can't buy food - or anything else for that matter.



Remember, it's The Future. The climate has changed rather horribly.



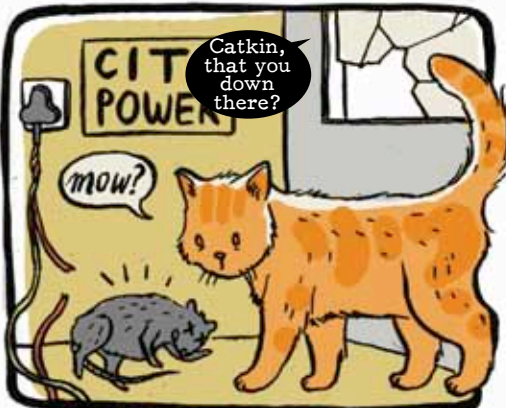
So many calls flew back and forth - till batteries died out.



Candles and diesel generators are things of The Past, a distant memory some grandparents know about.



The authorities work feverishly to find the cause of the problem.



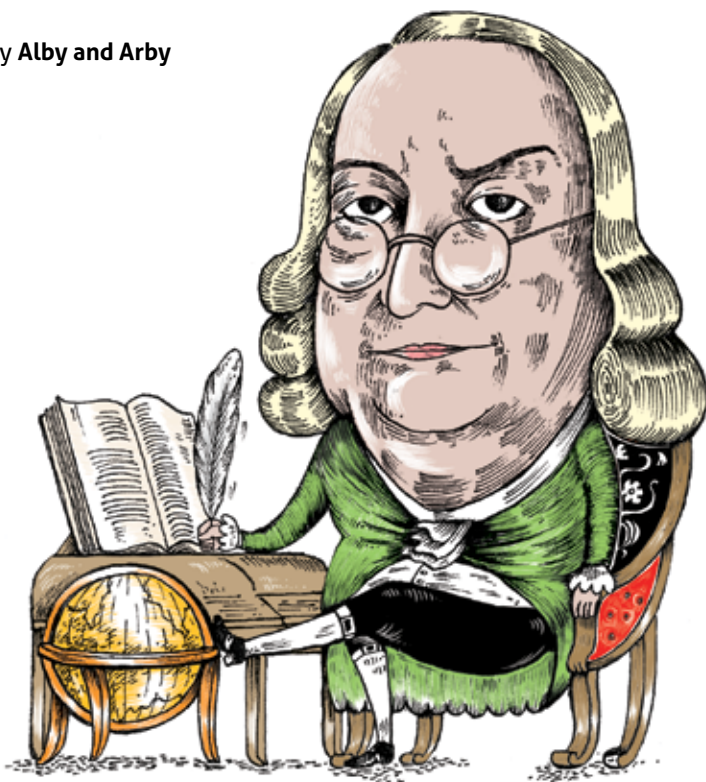
When the power is finally restored, the government decides to create a force of specially trained mouse-prevention cats.





The Lightning Man

by Alby and Arby



*A tale about static electricity, kites,
electric vocabulary and Ben Franklin.*

We traveled in Dr. Dodo's time machine to the year 1762, to meet Mr. Benjamin Franklin. We found him seated with a number of documents strewn around and a silk kite with a metal key attached to its string lying near by.

We introduced ourselves and told him that we were from the future.

Ben Franklin (not looking surprised): I see. Which year are you from?

Q: 2013. But why are you not surprised, sir?

Ben (chuckling): Time is such a curious thing. It would be interesting to know what time travel is like. But I am sure that you are not here to discuss time travel. What is your purpose of travelling back almost 300 years?

Q: How did you study electricity, sir?

Ben: Ah! It all began when I noticed that a number of houses were catching fire due to lightning! I wanted to understand why that happened and prevent it.

Q: Can you tell us more?


Ben: Yes. I wondered whether it generated electricity. I began studying it in great detail. One stormy day, I took

a silk kite, attached a sharp pointed wire to its tip and a metal key to its string and flew it.

Q: Wasn't that risky? You could have lost your life!

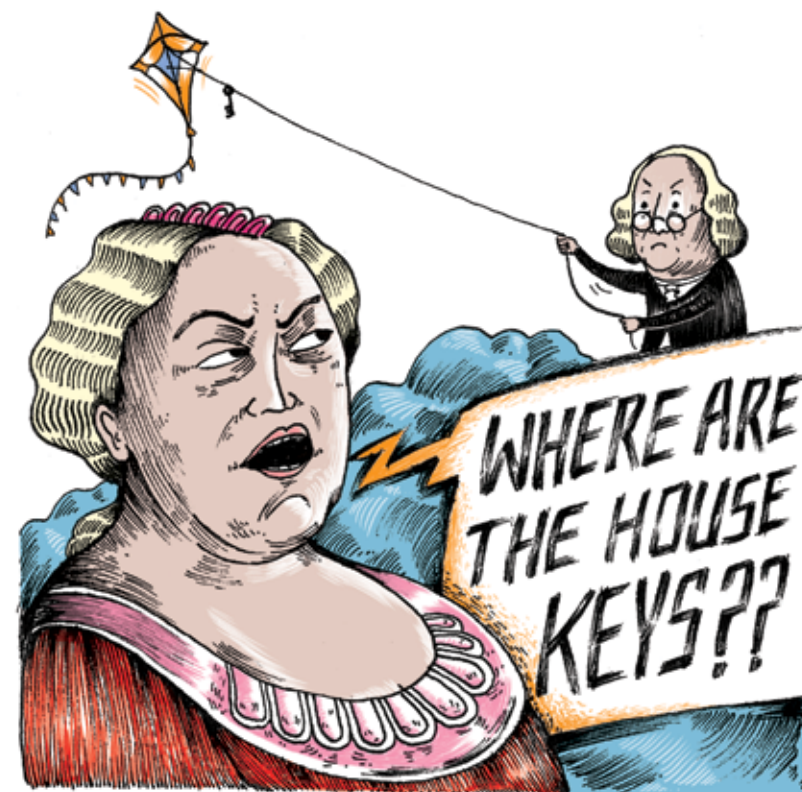
Ben: It was a risk worth taking. Electricity fascinated me. I can sell all my possessions to research more! Anyway, I took precautions. I did not touch the metal key directly. I also did not hold the string directly. I tied a silk ribbon to its end and held that. I proved that lightning contained static electricity.

Q: But, how did this discovery solve the problem of houses catching fire due to lightning?

Ben: You would be surprised! From what I learnt through my kite experiment, I invented  the lightning rod. It is a metallic rod installed on roof of your house. A wire connects the rod to earth. Lightning will strike the rod and be conducted to the ground through the wire, instead of striking your house.

Q: What else did you discover about electricity?

Ben: Electricity, like magnets, has positive and negative charges. I also coined terms for several



electrical devices and phenomena such as battery, conductor, condenser, charge, discharge, electric shock and electrician.

Q: That is so cool! What more have you done?

Ben: Young men, I have made contributions to science, english, politics and music. I had always nurtured the dream of being an all-rounder.

Q: How do you still have time to work on science, sir?

Ben: I try and devote as much time as I can.

However, I am more involved in politics now, for America's independence. I know that you boys are from the future, but don't reveal to me if America has gained its independence. It is a dream that I would like to see in reality for myself.

Ben: Till then, as you can see, I am very busy. Please excuse me. I would like to be alone. All the best for the 'future'!

So, we thanked Mr. Ben Franklin for en'lightening' us and departed. It was definitely an afternoon well spent! ■



ENERGY WAS NEVER THIS COOL

by Sasikanth C

Run a car on coffee or generate electricity through SMSes!

Scientists across the world have discovered that there are several sources of energy and fuel that can be used to generate electricity. Take a look at a few of them:

Muscle power: You did not read it wrong. It is true! A gym in Hong Kong generates energy using the calories you burn. The equipment on the outside resembles regular machines, but inside, they contain generators that convert muscle power into usable energy. It is speculated that 50 watts of energy can be generated in one hour.

Coffee power: Did you know that coffee produces oil? It is true! When hot coffee cools, it forms a layer at the top, which is oil. This oil, believe it or not, can be used as a biodiesel alternative, which means that your cars can also have a caffeine rush!

Microorganism power: Scientists have experimented with *E. coli*, a bacteria that can cause stomach cramps and vomiting in humans, and modified its genetic makeup such that it excretes crude oil. This could solve all our petrol-related problems!



Text power: One of the innovative entries into the 2008 Greener Gadgets Design Competition came up with the Push-to-Charge mobile phone that runs on 'text power'. These cell phones will feature plastic buttons atop a layer of hard metal. The bottom-most layer will be made out of piezoelectric crystals.

Each time you press a button, the hard metal underneath it would hit the crystal like a hammer creating a small amount of voltage. Small wires located between the layers will convey the charge to a battery for storage, thus generating **piezoelectricity**⁶.

Manure power: Imagine smelly cakes of cow dung generating power! Scientists have, for many years extracted methane from cow dung to make biogas fuel. In Kern County, California, a company called BioEnergy Solutions uses this method to produce 650,000 cubic feet of biogas from manure, enough to provide power to 200,000 households! ■



LET US SAVE SOME GAS

by Jayadev Calamur

Fuel is a precious resource that is depleting. But we can reduce our fuel consumption through alternate methods. Cooking is one area we can work on. Share these tips with your parents to save cooking fuel at home.



1. Cover saucepans with lids to reduce the heat that escapes. Food cooks faster this way.

2. Cook on a simmering flame rather than a large flame. It

may take longer to cook, but will save a lot more fuel.

3. Dice vegetables into smaller sizes. The smaller they are, the faster they cook. ■

Write to us at:
jayadev.calamur@ack-media.com
with your ideas to save gas. You
can win a copy of the Amar Chitra
Katha comic 'Konark'.

Artwork: Parvati Pillai

The Burning Note

by Sasikanth C



MAGIC
SCIENCE



Image Source: Wikimedia Commons

Here is a trick that you can awe your friends with. All you need is a currency note (use smaller denominations), a pair of tongs available in your kitchen, matchbox, and surgical spirit. Surgical spirit is available at your local medical store.

Ensure that a parent is around to supervise. Dip the note in the spirit. Pick it up with the tongs. Light the note and wait. You will

see that the fire soon goes out without burning the note!

Tell us how this happened. Write to brainwave@ack-media.com and win a gift voucher worth Rs. 500!

Experiments such as these resulted in the birth of chemistry as an organised discipline in the late 1700s. Before that, most phenomena were considered to be magic. ■

View the video at: <http://www.youtube.com/watch?v=OqFTZEZTJfE>



The Current is Strong with them

Let stunning facts about these bioelectric animals shock you.

by Dr. Dodo



The electric eel, Image source: Steven G. Johnson

There are so many creatures that use electricity. Some use it to attack prey or defend themselves while others use it to navigate ocean floors.

We have read about them in magazines or seen them on television.

Most of these creatures are found in the Pacific Ocean or in the rivers of South America, and

across many parts of Africa.

Some of the more popular creatures include the electric eel, the electric ray, the duck-billed platypus and the electric catfish.

Electric eel

The electric eel is not an eel. It is, in fact, a fish that produces electricity. Some electric eels can produce up to 600 volts of electricity! They use it for offence and defence.

Electric ray

Remember the famous 'crocodile hunter', Steve Irwin, who would wrestle with crocodiles and pythons? Irwin was stung to death by an electric ray. There are over 60 species of electric rays. They can generate 8 volts to 220 volts of electricity! It is also called as stingray. Isn't it best to stay away from this deadly creature?



The electric ray, Image Source: NOAA's Fisheries Collection

Duck-billed platypus

The duck-billed platypus is named so because of its

bill (the area that forms into its mouth) that resembles a duck's beak. This bill generates electricity and helps the animal catch its prey.



Duck-billed platypus, Image source: Wikimedia Commons

Electric catfish

This freshwater catfish, native to the tropical waters of Africa, can grow to a whopping 44 pounds. It has the ability to generate 350 volts of electricity, which is enough to run a computer for 45 minutes! Made up of modified muscle tissue, its electric organ forms a gelatinous layer just underneath its skin. However, there is no recorded proof that a catfish has stunned a human, as yet. ■

Surf the Internet and make a list of at least five other creatures that use bioelectricity.
Email it to brainwave@ack-media.com and you can win an ACK DVD worth Rs. 1450.



A NATURAL LABORA-THOR-Y

STORY: JAYADEV CALAMUR
ART & LETTERING: ABHIJEET KINI

THE SMARTIES ARE WATCHING THOR -

THAT'S PRETTY SIMILAR TO BEN FRANKLIN'S
LIGHTNING ROD THEORY.

OH YES!

GUYS, DO YOU THINK THAT IF WE ACTUALLY MADE A
GIGANTIC LIGHTNING ROD* AND CONNECTED IT TO A
POWERFUL BATTERY, WE COULD PRODUCE ELECTRICITY?

I'M SURE THAT
WE COULD.

WHILE LIGHTNING HAS HIGH
VOLTAGE, IT HAS LESS
CURRENT. WE NEED TO MAKE
SOME CLEVER MODIFICATIONS.

I'LL CONVERT STATIC TO CURRENT ELECTRICITY
I CAN USE SUPER CONDUCTORS AND LASERS.

I WILL INSTALL THE UNDERGROUND
SUPPLY CABLES, JUNCTION BOXES,
SWITCHES AND METERS THAT WE NEED.

DR. DODO AND I WILL
CREATE AND INSTALL A
UNIQUE STEP-UP
TRANSFORMER, TO GET
MORE POWER.

AND THEY START WORK...

BW LABS AT WORK,
BW LABS AT WORK,

WE LOVE SCIENCES,
WE LOVE PLAYING WITH APPLIANCES,

OH, BW LABS
AT WORK!

FINALLY...

IT'S
READY!

ABOUT TIME TOO.
TURN THE MAINS
OFF. LET'S TEST IT!

OUCH!

YOU'RE STANDING
ON MY TALON!!

SORRY, DOCTOR.

THE POWER IS SOON RESTORED -

WE'RE COOLER
THAN THOR!

OF COURSE WE ARE!

WITH THAT, BW LABS PROGRESSED IN ITS JOURNEY OF ACHIEVING A POSITIVE CARBON FOOTPRINT. IT IS THE ONLY LAB IN THE WORLD RUNNING ON NATURAL POWER SOURCES.



A GREEN VROOM

by Sasikanth C



We love anything and everything about cool cars. But the rising prices of fuel get the better of us and leave us frustrated. An alternative to such a situation is to buy eco-friendly cars. Many celebrities have already begun buying these. Hopefully, Indians will adopt this idea soon.

George Clooney: Clooney redefines cool. Now he has the wheels to prove it. He has two eco-friendly cars: the Tesla Roadster and the

Tango. While the first one is the first attempt at making an all-electric sports car, the Tango is a cute, little car that can pick up speed (0-60 mph in four seconds). The car is all set to defy the notion that electric cars run slower than fuel-powered ones.

Angelina Jolie: While all of us know Angelina Jolie for her action roles in movies such as *Lara Croft: Tomb Raider*, *Salt*, and *Mr. and Mrs. Smith*, very few know that she is quite the

environmentalist. She owns a rare car called the BMW Hydrogen 7. As the name suggests, the car runs on hydrogen instead of petrol. This means that when it runs, hydrogen burns in air and gives out water.

Paris Hilton: Who would have imagined that the hotel heiress owns a Cadillac Escalade Hybrid, which runs either on petrol or on electricity? It is also known as the 'bling car'. No wonder, Paris Hilton owns one! ■


Volt Up

*Our lives are incomplete and immobile without the battery.
Know more about this essential electrical component.*

by **Sasikanth C**

When buying gadgets, we pay a great deal of attention to the battery, how long it would last, the size and the type. Everything seems to be running on batteries, hence these details are important.

My laptop runs on a battery; so does my car. Think for a moment how life would be without batteries. It sounds freaky! Our reliance on batteries is the reason that we have chosen the battery as the gizmo of the month.

The first battery, invented by Alessandro Volta in 1800, consisted of pairs of copper and zinc discs piled atop each other, separated by a layer of cloth or cardboard soaked in brine. After testing various metals, he discovered  that zinc and

copper gave the best results.

Since then, the battery has gone through a series of transformations. Compare the battery in your TV remote or wall clock with the one in your mobile phone.

The TV remote has a nickel-cadmium battery. Compared to Volta's pile, it is easy to use and affordable. The mobile phone battery is a lithium-ion one. It is an advancement over the TV remote battery. It is low on maintenance and can be recharged repeatedly.

Batteries have enabled communication to such an extent that people can get pretty anxious over their phone or laptop battery going dead. ■



BM = Battery Man



CELL PHONE BLUES

Your parents need not fret when your phone gets wet. Follow these simple instructions and fix it!

by Sasikanth C

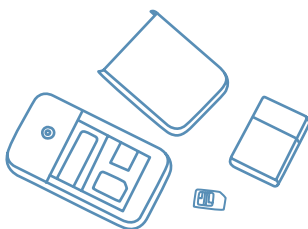
When it comes to cell phones, all of us are careless. We have dropped it on the ground and even dunked it in water. Unfortunately, dunking it in water can be a disaster and damage the phone completely.

However, one can fix a wet cell phone. It is an overnight process. Try this before you consider trashing the phone and buying a new one.

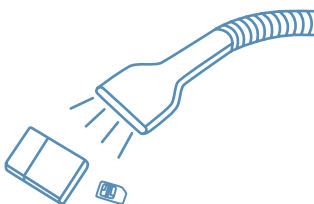
Follow these steps:



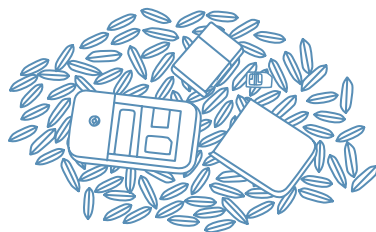
- 1 Take the phone out of the water as soon as possible. The plastic cover is tight, but water might still have entered the phone. Switch off the phone immediately because leaving it on can result in a short circuit and destroy the phone.



- 2 Remove the battery. If you break the circuit, there is no chance of your phone getting totally damaged.
- 3 Remove the SIM card as well.
- 4 Take apart your phone so that it dries well in the open.



- 5 Use a paper towel and wipe off the water. You can use a vacuum cleaner to suck out the water that cannot be dried with the towel. Sometimes, water goes into the corners of the phone, making it difficult to dry it.



- 6 Put your phone on uncooked rice to absorb the remaining moisture.
- 7 Test your phone 24 hours later. It might be as good as new.

Caution:

Do not dry your phone in the Sun. Excessive heat can damage the phone.

Using a hair dryer may force moisture further into the small components that are deep inside the phone. Also, the air might be too warm and melt some parts.

Be careful not to hold the vacuum cleaner too close to the phone. A vacuum cleaner can create static electricity, which is bad for the phone. ■

BE A SMARTY!

The Smarties are relaxing in the BW Labs. But wait, not all is right! A few things happening here seem to be scientifically impossible.


Spot any five of those mistakes and email them to brainwave@ack-media.com. You can win a cool remote controlled chopper.




Artwork: Abhijeet Kini



Treasure Hunt!

We are back! Take your magnifying glass out and become an explorer. This month too, we have a list of hints strewn across the magazine. Each clue is represented by the  symbol.

You have to unearth the theme of the February 2013 issue. Rake your brains, scratch your heads and come up with ideas  to find it. Read the magazine carefully to discover clues that will lead you to the right answer.

oooooooo

Start now! The first entry with the correct answer will win a **gift voucher worth ₹500**. With 'Treasure Hunt' as the subject, write to us at brainwave@ack-media.com





p06

Cosmos: The world or universe regarded as an orderly and harmonious system.

p06

Cubic light year: 1 light year is the distance light travels in one year in space. It is approximately equal to 10 trillion kilometers. 1 cubic light year is $(1 \text{ light year})^3$. It is used to measuring the volume of space.

p15

Photovoltaic cell: Photovoltaic effect is the process through which current is produced upon exposure to light. A photovoltaic cell is an electrical device that works on this principle.

p15 & p17

Stepping up and stepping down: To increase and reduce, respectively, especially in stages.

p16

Electromagnetism: Magnetism produced by an electric charge in motion.

p16

Electromagnetic Induction: The process where electricity is produced by the motion of a conductor in a magnetic field.

p16

Industrial Revolution: The rapid development of industry in the USA and the UK during late 18th and 19th centuries, brought about by scientific advancements in machinery and electricity.

p17

Direct Current and Alternating Current: Direct Current flows in only one direction. Alternating Current reverses its direction many times a second at regular intervals.

p28

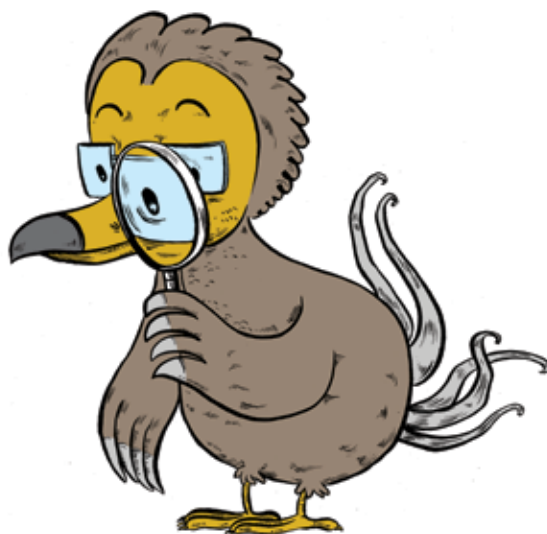
Anatomy: The structure of an animal or plant, or of any of its parts.

p29

Earth Hour: Earth Hour is an annual event organized by the World Wildlife Fund. It is held on the last Saturday of March and encourages us to turn off lights for one hour, between 8:30 p.m. and 9:30 p.m. This is done to raise awareness about conservation of electricity.

p36

Piezoelectricity: The production of electricity or electric polarity by applying mechanical stress to certain crystals.



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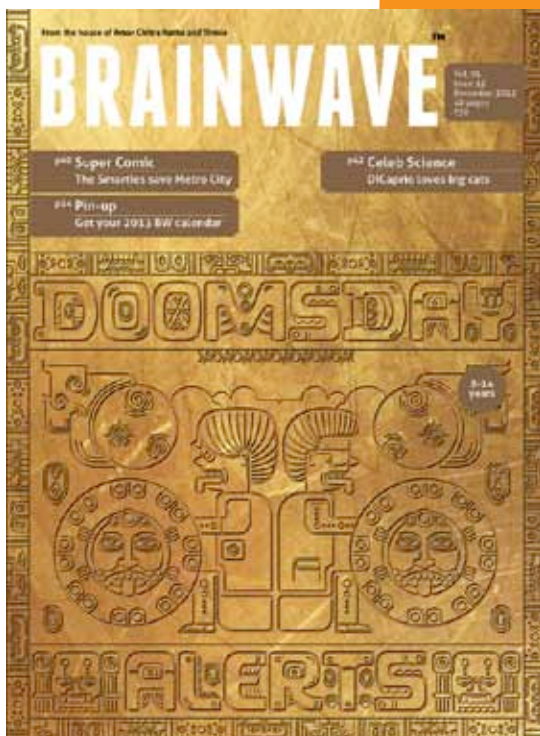
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